Faculty of Science, Technology, Engineering and Mathematics
MST210 Mathematical methods, models and modelling

MST210

TMA 01 2019J

Covers Unit 1 **Cut-off date 30 October 2019**

The module website gives details of how to submit assignments for this module.

The marks allocated to each part of each question are indicated in brackets in the margin.

You may use Maxima to check answers, but it should not be used otherwise to answer TMA questions except where explicitly indicated. TMA answers must show full working to attract full marks.

In order to encourage you to present your solutions to the TMA questions in a good mathematical style, your tutor will comment on how you:

- use correct mathematical notation
- define any symbols that you introduce in formulating and solving a problem
- give references for standard formulas and derivations
- include comments and explanations within your mathematics
- explicitly state results and conclusions, giving answers to an appropriate degree of accuracy and interpreting answers in the context of the question
- draw diagrams and graphs.

These features are seen as being essential to complementing your mathematical skills. Your tutor will make comments on how well you achieve these objectives and give you guidance on how to satisfy them.

No marks for this are allocated for this assignment, but you should read your tutor's comments carefully to ensure that you do not lose marks on future assignments.

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6.1

Question 1 (Unit 1) – 6 marks

Consider the differential equation

$$\frac{dy}{dx} = \frac{1}{y(x^2+1)}, \quad y > 0.$$

Which of the methods of finding analytic solutions of differential equations described in Unit 1 would you use to solve this equation? Briefly justify your answer.

Find the general solution of the differential equation, expressing y explicitly as a function of x. Hence find the particular solution of the differential equation that satisfies the initial condition $y(1) = 0$. [*6*]

Question 2 (Unit 1) – 6 marks

Consider the differential equation

$$\frac{dy}{dx} + \frac{y}{x} = x, \quad x > 0.$$

Which of the methods of finding analytic solutions of differential equations described in Unit 1 would you use to solve this equation? Briefly justify your answer.

Find the general solution of the differential equation, expressing y explicitly as a function of x. Hence find the particular solution of the differential equation that satisfies the initial condition $y(1) = 1$. [*6*]

Question 3 (Unit 1) – 13 marks

Find the solution of the differential equation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = 0$$

that satisfies the initial conditions $y = 1$ and $dy/dx = 1$ when $x = 0$. [*13*]